Remarks: Examination Report

It is submitted that with the amended claims herein, the objections raised against the claims are overcome.

1. Section 1 of the Examination Report

The Office Action is in response to the office letter filed on 4/28/2004 and is non-final.

2. Section 2 of the Examination Report

The previous rejections of claims 82, 87, 88, 93-100, 104-106, 110, 111, 119-126, 129-131, 135, and 136 under 35 USC 102(b), 35 USC 102(e) and 35 USC 103(a), have been withdrawn. However, new grounds for rejection are made in view of additional prior art.

3. Section 3 of the Examination Report

Claims 44-47, 50-76, 80-87, 89, 96-99, 101-109, 111-117, 121-124, 126-134, and 136 were rejected under 35 U.S.C. 102(b) as being anticipated by Tomisato, et. al. (U.S. Pat. No. 5,504,783).

In particular, the Examiner states that Tomisato shows carriers that each have a phase offset and produce pulses that are substantially orthogonal in time, such as with reference to figures 12(a)-12(d) in Tomisato. In fact, Tomisato shows a coding technique that is quite different than the multicarrier protocol described in Applicant's claimed invention.

4. Tomisato fails to show multiple carriers provided with phase offsets that produce pulses that are substantially orthogonal in time.

Figures 12(a)-12(d) in Tomisato show binary orthogonal functions that are well-known Walsh functions (col. 10, lines 61-65 and col. 11, lines 16-18), which are modulated onto carrier frequencies. The functions shown in Figures 12(a)-12(d) illustrate code chips modulated onto frequencies, not pulse waveforms in time. Each user applies a unique orthogonal Walsh function chip by chip to the individual carrier frequencies (col. 10,

lines 45-49). Thus, Tomisato actually **teaches away** from the claimed invention, since it is well known that binary codes (such as Walsh codes) applied to conventional multicarrier (e.g., OFDM) signals **cannot produce orthogonal pulse waveforms**. Furthermore, Tomisato neither describes nor shows a composite waveform resulting from a superposition of coded carrier frequencies. Thus, Tomisato neither describes nor shows a multicarrier modulation technique for mapping data symbols to orthogonal pulse waveforms generated from a superposition of a plurality of coded carrier frequencies.

5. Since the Examiner's basis for rejecting claims 44-47, 50-76, 80-87, 89, 96-99, 101-109, 111-117, 121-124, 126-134, and 136 relies on the interpretation of figures 12(a)-12(d) in Tomisato showing orthogonal pulse waveforms, Applicant believes the rejection is successfully traversed by clarifying that Tomisato shows and describes orthogonal Walsh codes applied to multicarrier signals in the frequency domain that are incapable of producing orthogonal pulse waveforms in time. Thus, the claimed invention distinguishes itself over Tomisato and the other prior-art references and thus, claims 44-47, 50-76, 80-87, 89, 96-99, 101-109, 111-117, 121-124, 126-134, and 136 should be considered patentable under 35 U.S.C. 102 and 35 U.S.C. 103.

6. Independent Claim 44 recites "providing the carriers with at least one predetermined phase space (16n), each phase space mapping a data symbol to one of a plurality of pulse waveforms generated from a superposition of the carriers and centered at a predetermined instant in time, the pulse waveforms being positioned substantially orthogonally in time." Thus, Independent Claim 44 and dependent claims 45-61 provide a novel method over the prior art, including Tomisato.

7. Independent Claim 62 recites "providing phase-space compensation to the carrier-signal components (60mn), each phase space corresponding to a data symbol mapped onto one of a plurality of pulse waveforms generated from a superposition of carriers and centered at a predetermined instant in time, the pulse waveforms being positioned substantially orthogonally in time." Thus, Independent Claim 62 and dependent claims 63-66 provide a novel method over the prior art, including Tomisato.

8. Independent Claim 67 recites "providing the carriers with at least one predetermined phase space (16n), each phase space mapping a data symbol to one of a plurality of pulse waveforms generated from a superposition of the carriers and centered at a predetermined instant in time, the pulse waveforms being positioned substantially orthogonally in time." Thus, Independent Claim 67 provides a novel method over the prior art, including Tomisato.

9. Independent Claim 68 recites "a phase-space controller (16n) adapted to provide the carriers with at least one predetermined phase space, each phase space mapping a data symbol to one of a plurality of pulse waveforms generated from a superposition of the carriers and centered at a predetermined instant in time, the pulse waveforms being positioned substantially orthogonally in time." Thus, Independent Claim 68 and dependent claims 69-81 present novel structure over the prior art, including Tomisato.

10. Independent Claim 82 recites "a combiner capable of combining the plurality of received multi-frequency carrier-signal components with respect to the at least one phase space to produce at least one constructive interference signal indicative of at least one information signal." Thus, Independent Claim 82 and dependent claims 83-88 present novel structure over the prior art, including Tomisato.

11. Independent Claim 89 recites "a phase-space controller (16n) adapted to provide the carriers with at least one predetermined phase space, each phase space mapping a data symbol to one of a plurality of pulse waveforms generated from a superposition of the carriers and centered at a predetermined instant in time, the pulse waveforms being positioned substantially orthogonally in time." Thus, Independent Claim 89 presents novel structure over the prior art, including Tomisato.

12. Independent Claim 96 recites "providing for mapping values of the multicarrier signal after channel compensation at instants in time used to transmit symbol values." Thus, Independent Claim 96 presents a novel method over the prior art, including Tomisato.

13. Independent Claim 97 recites "providing for generating at least one pulse waveform from a superposition of the selected multi-frequency carriers." Thus, Independent Claim 97 presents a novel method over the prior art, including Tomisato.

14. Independent Claim 98 recites "a combiner coupled to the filter, the combiner adapted to combine the received multi-frequency carriers to produce at least one signal indicative of a modulated pulse waveform." Thus, Independent Claim 98 presents novel structure over the prior art, including Tomisato.

15. Independent Claim 99 recites "a combiner coupled to the filter, the combiner adapted to optimally combine the received multi-frequency carriers in the presence of at least one of interference and multipath to generate at least one signal indicative of a modulated pulse waveform." Thus, Independent Claim 99 presents novel structure over the prior art, including Tomisato.

16. Independent Claim 101 recites "a decision module adapted to map values of the multicarrier signal after channel compensation at instants in time used to transmit symbol values." Thus, Independent Claim 101 presents novel structure over the prior art, including Tomisato.

17. Independent Claim 102 recites "generating a superposition signal by applying a pulse function to the discrete signal, the pulse function operating on the discrete signal such that a frequency response of the superposition signal includes sinusoids having non-zero values at predetermined frequencies and zero values at frequencies other than the predetermined frequencies." Thus, Independent Claim 102 presents a novel method over the prior art, including Tomisato.

18. Independent Claim 103 recites "providing for generating a superposition signal by applying pulse functions to the discrete signal such that a frequency response of the

digital signal sample vector includes sinusoids having non-zero values at allocated carrier frequencies, and zero values at carrier frequencies other than the allocated carrier frequencies." Thus, Independent Claim 103 presents a novel method over the prior art, including Tomisato.

19. Independent Claim 104 recites "providing for generating at least one pulse waveform from a superposition of the selected multi-frequency carriers." Thus, Independent Claim 104 presents a novel method over the prior art, including Tomisato.

20. Independent Claim 105 recites "a pulse generator coupled to the carrier generator, the pulse generator adapted to produce at least one pulse waveform from a superposition of selected multi-frequency carriers." Thus, Independent Claim 105 presents novel structure over the prior art, including Tomisato.

21. Independent Claim 106 recites "a pulse generator adapted to produce at least one pulse waveform having a plurality of multi-frequency carrier components." Thus, Independent Claim 106 presents novel structure over the prior art, including Tomisato.

22. Independent Claim 107 recites "a pulse-generation circuit adapted to receive the discrete signal and generate a pulse sequence by applying predetermined pulse functions to the discrete signal, the pulse functions operating on the discrete signal such that values of the pulse sequence at the prescribed time instants are equal to the information symbols, and a frequency response of the pulse sequence includes sinusoids having non-zero values at frequencies within the allocated carrier set and zero values at the remaining frequencies." Thus, Independent Claim 107 presents novel structure over the prior art, including Tomisato.

23. Independent Claim 108 recites "a pulse generator adapted to receive the discrete signal and generate a pulse train by applying a pulse function to the discrete signal wherein the pulse generator operates on the discrete signal such that a frequency

response of the pulse train includes sinusoids having non-zero values at the allocated carrier frequencies, and zero values at frequencies other than the allocated carrier frequencies." Thus, Independent Claim 108 presents novel structure over the prior art, including Tomisato.

24. Independent Claim 109 recites "a pulse generator adapted to receive the discrete signal and generate a pulse train by applying a pulse function consisting of a superposition of the allocated carrier frequencies to the discrete signal wherein the pulse function operates on the discrete signal such that values of the pulse train at the prescribed time instants are equal to the mapped symbols." Thus, Independent Claim 109 presents novel structure over the prior art, including Tomisato.

25. Independent Claim 111 recites "a data source coupled to the modulator, the data source adapted to process a plurality of information symbols to generate the data symbols with a predetermined set of phase relationships and amplitude profiles to provide a superposition of the carriers with orthogonality in time." Thus, Independent Claim 111 presents novel structure over the prior art, including Tomisato.

26. The claimed invention is also non-obvious, making the claims patentable under U.S.C. 103.

27. As detailed above, the cited art describes a different type of multicarrier communication system to that claimed by the present invention. Although different to the present invention, such transmission systems have use with respect to prior-art multicarrier signaling, as is evidenced by the teaching of the prior art. Such use is served by Tomisato's transmitter and there is no teaching in the prior art to change the type of transmitter provided so as to resemble or reflect that of the present invention. As there is no motivation to change, no teaching to change, and no description of how any change may be made to produce a CIMA transmitter, it is submitted that the presently claimed invention is also non-obvious, making the claims patentable under U.S.C. 103.

28. **Further reasons suggest that the invention is non-obvious and worthy of patent protection**. For example, in-phase combining of multi-frequency signals is **taught against by the relevant art** because, unlike in the present invention, the resulting peak-to-average power of multicarrier signals becomes very high. Rather, the present invention deliberately generates constructive-interference pulses (which have the highest possible peak-to-average power) from multicarrier signals and then positions the pulses orthogonally in time, resulting in an aggregate signal having very low peak-to-average power. Accordingly, the present invention **solves an important and recognized problem in the art** of multicarrier signaling by implementing in-phase combining, which is clearly **taught against by the prior art**. Transmission in the present invention is characterized by a sequence, or stream, of pulses that result in an overall low peak-to-average power, which is truly an **unanticipated and unexpected consequence** in view of the current teaching in the art. The claimed receiver of the present invention pertains to processing CIMA signals, which are significantly different than all prior-art multicarrier signals. Since conventional multicarrier transmitters and receivers do not provide an optimal solution for processing CIMA signals, the present invention **solves a different problem** than prior-art multicarrier systems and methods. As there is no motivation to change, no teaching to change, and no description of how any change may be made to process CIMA signals, it is submitted that the presently claimed invention is also non-obvious, making the claims patentable under U.S.C. 103.

29. Claim 88 was rejected under 35 U.S.C. 103(a) as being unpatentable over Tomisato in view of Odenwalder. Since Claim 88 is dependent on Claim 82, and Applicant has argued the novelty of Claim 82 over Tomisato and the other prior art, Dependent Claim 88 should also be considered patentable under 35 U.S.C. 103.

30. Prior-art references not relied upon: These references were reviewed and considered by the Applicant to be of little relevance to the claimed invention.

31. Conclusion

The Applicant submits that every effort has been made to address the Examiner's objections and that the Application is now in condition to proceed to grant.

Yours Respectfully,

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